Ionic liquid technology for metal separation and NdFeB magnet recycling

Tom Vander Hoogerstraete and Koen Binnemans

KU Leuven, Department of Chemistry, University of Leuven, Celestijnenlaan 200f - box 2404, 3001 Heverlee (Belgium)

Ionic liquids (ILs) are defined as organic salts that melt below 100°C.[1] Solvent extraction systems using ILs as organic phase have some interesting properties which differ from conventional extraction systems using traditional molecular sovents such as kerosene, toluene or DCM. ILs have a negligible vapor pressure, they are non-flammable and they show a broad liquidus range. Although the applicability of ILs for metal separations on a larger scale has been proven,[2] the thresholds for applying these environmentally friendlier alternatives on a laboratory and industrial scale is often the price and their slower kinetics due to the high viscosity.

In 2010, the European Commission stressed the importance of starting up technospheric mining (recycling scrap or End-of-Life consumer goods) to cover rare earths.[3] In their report, it was stated that these elements have the highest supply risk in the near future. As NdFeB magnets take almost half of the rare-market by value, it is of crucial importance to build valuable recycling routes.

In our extraction studies, simple, cheap and non-fluorinated ILs are used as an undiluted organic phase to separate transition metals from rare earths without the need of additional extractants.[4] Special attention is given to the viscosity and the maximal metal loading of the IL, as these are important parameters towards the applicability of ILs in industrial hydrometallurgic separation systems. It will be shown that ILs can be used to separate very efficiently the elements present in NdFeB magnets.

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3. European Commission, Report: Critical raw materials for the EU, Report of the Ad-hoc Working Group on defining critical raw materials, 2010.
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